

1     Claims

2

3     1. A process for preparing a particulate solid  
4     material comprising the steps of:

5     (a) obtaining a paper-fibre waste solid material  
6     having a ratio of china clay, or equivalent, to  
7     chalk, or equivalent, greater than a pre-determined  
8     minimum;

9     (b) treating the material to reduce the moisture  
10    content and form a granular material; and

11    (c) calcining the granular material at a temperature  
12    of approximately 1300°C or higher to provide a  
13    particulate, 100% solids, material.

14

15    2. A process as claimed in claim 1 wherein the  
16    paper-fibre waste solid material is non-hazardous  
17    waste material arising from the recycling of waste  
18    paper and tissue.

19

20    3. A process as claimed in claim 2 wherein the  
21    paper-fibre waste solid material is in the form of  
22    sludge.

23

24    4. A process as claimed in any one of the preceding  
25    claims wherein the paper-fibre waste solid material  
26    has a moisture content of over 45%.

27

28    5. A process as claimed in claim 4 wherein the  
29    paper-fibre waste solid material has a moisture  
30    content of over 55%, optionally 60%.

31

1 6. A process as claimed in any one of the preceding  
2 claims wherein minor components in the paper-fibre  
3 waste solid material including non-fibrous  
4 contraries materials are removed prior to step (b).  
5

6 7. A process as claimed in any one of the preceding  
7 claims wherein the paper-fibre waste solid material  
8 is waste paper from a paper making process.  
9

10 8. A process as claimed in any one of the preceding  
11 claims wherein the china clay or equivalent includes  
12 any form of hydrated aluminium silicate, including  
13 kandites, kaolins and the like.  
14

15 9. A process as claimed in any one of the preceding  
16 claims wherein the chalk or equivalent includes any  
17 form of calcium carbonate, which includes the forms  
18 of limestone.  
19

20 10. A process as claimed in any one of the preceding  
21 claims wherein the process further includes the step  
22 of:  
23 dewatering the paper-fibre waste solid material  
24 prior to step (b).  
25

26 11. A process as claimed in claim 10 wherein the  
27 dewatering process provides a sludge material having  
28 a solids content generally in the range 22-55%.  
29

30 12. A process as claimed in claim 10 or claim 11  
31 wherein analysis of the china clay:chalk ratio is

1 carried out prior to the dewatering of the waste  
2 material.

3

4 13. A process as claimed in any one of the preceding  
5 claims wherein the determination of the ratio of the  
6 china clay:chalk is carried out using the 'acid  
7 extraction' method.

8

9 14. A process as claimed in claim 13 wherein the  
10 pre-determined minimum ratio using the "acid  
11 extraction" method is approximately 0.2.

12

13 15. A process as claimed in any one of claims 1 to 12  
14 wherein the determination of the ratio of the china  
15 clay:chalk is carried out using the "ash/acid  
16 extraction" method.

17

18 16. A process as claimed in claim 15 wherein the  
19 pre-determined minimum ratio using the "ash/acid-  
20 extraction" method is approximately 0.13.

21

22 17. A process as claimed in any one of the preceding  
23 claims wherein a conditioning material is added to  
24 the paper-fibre waste solid material in step (a).

25

26 18. A process as claimed in claim 17 wherein the  
27 conditioning agent raises the china clay:chalk ratio  
28 above the pre-determined minimum.

29

30 19. A process as claimed in claim 17 or claim 18  
31 wherein the conditioning material is partly,

1 substantially or wholly china clay, or at a china  
2 clay suspension, or another silicate material.

3

4 20. A process as claimed in any one of claims 17 to  
5 19 wherein a dispersing agent is added with the  
6 conditioning agent.

7

8 21. A process as claimed in any one of claims 17 to  
9 20 wherein the material has a solids content of less  
10 than 45%, optionally 22% or lower.

11

12 22. A process as claimed in any one of the preceding  
13 claims wherein the ratio of silica and aluminium to  
14 natural fillers in the paper-fibre waste solid  
15 material is also determined.

16

17 23. A process as claimed in any one of the preceding  
18 claims wherein the treatment step (b) includes  
19 compression and/or extrusion of the material.

20

21 24. A process as claimed in Claim 23 wherein step  
22 (b) is carried out by a granulating press.

23

24 25. A process as claimed in any one of the preceding  
25 claims wherein the treatment step (b) is provided by  
26 direct heat contact.

27

28 26. A process as claimed in claim 25 wherein a heat  
29 transfer material is used.

30

1 27. A process as claimed in any one of the preceding  
2 claims wherein the treatment step (b) is carried out  
3 with agitation.

4  
5 28. A process as claimed in claim 27 wherein the  
6 agitation is provided by a rotary apparatus.

7  
8 29. A process as claimed in claim 28 wherein the  
9 rotary apparatus is inclined.

10  
11 30. A process as claimed in claim 28 or claim 29  
12 wherein the rotary apparatus allows for a wholly or  
13 substantially continuous feed of material.

14  
15 31. A process as claimed in any one of the preceding  
16 claims wherein the treatment step (b) is carried out  
17 at a raised temperature, optionally between 60-80°C.

18  
19 32. A process as claimed in any one of the preceding  
20 claims wherein step (b) is carried out under an  
21 inert atmosphere.

22  
23 33. A process as claimed in any one of the preceding  
24 claims wherein the granular material provided by  
25 step (b) comprises granules in the range 3mm-30mm in  
26 size.

27  
28 34. A process as claimed in any one of the preceding  
29 claims wherein the granular material formed by step  
30 (b) is reduced in size, optionally by grinding or  
31 milling.

32

1 35. A process as claimed in any one of the preceding  
2 claims wherein the granular material formed by the  
3 treatment step (b) has a solids content in the range  
4 of approximately 45-90% solids.

5

6 36. A process as claimed in any one of the preceding  
7 claims wherein the calcining of the granular  
8 material reduces the moisture in the material wholly  
9 or substantially to zero.

10

11 37. A process as claimed in any one of the preceding  
12 claims wherein particulate material being formed by  
13 step (c) is partly or substantially porous.

14

15 38. A process as claimed in any one of the preceding  
16 claims wherein the granular material is calcined  
17 with agitation.

18

19 39. A process as claimed in claim 38 wherein the  
20 agitation is provided by a rotary apparatus.

21

22 40. A process as claimed in claim 39 wherein the  
23 rotary apparatus is a high temperature rotary  
24 furnace tube.

25

26 41. A process as claimed in any one of the preceding  
27 claims wherein the calcining temperature is greater  
28 than 1300°C, optionally approximately 1320°C, or  
29 optionally higher.

30

1 42. A particulate solid material whenever prepared  
2 by a process as defined in any one of claims 1 to  
3 41.

4  
5 43. A particulate solid material formed from a  
6 paper-fibre waste solid material having a bulk  
7 density of less than  $1,000\text{kg/m}^3$ , preferably in the  
8 range  $560\text{kg/m}^3$  to  $800\text{kg/m}^3$ , and in the form of an  
9 aggregate having a mean particle size in the range 3  
10 to 15mm.

11  
12 44. A particulate solid material as claimed in claim  
13 42 or claim 43 being a light-weight aggregate for  
14 making cementitious, concrete or other building  
15 blocks.

16  
17 45. A particulate solid material as claimed in claim  
18 42 or claim 43 having a particle size of less than  
19  $100\mu\text{m}$ , and being a cementitious material.